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MEMORANDUM

SUBJECT: Revised FQPA Drinking Water Assessment for Chlorpropham

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DATE: June 3, 2002

SUMMARY

This memo presents a revised drinking water exposure assessment for chlorpropham and its degradate 3-chloroaniline. The original assessment was done in February 1999 and did not include an assessment for the 3-chloroaniline degradate. Chlorpropham is applied to Easter lilies in two coastal counties in the states of Oregon and California (Curry County, OR and Del Norte County, CA) and to gingko trees in Washington DC. There are no drinking water intakes on the Potomac River downstream from Washington DC; therefore, this drinking water exposure assessment focuses on the two Oregon and California counties.

The intakes to the surface water source public drinking water facilities in Curry and Del Norte Counties are located out of the range of the lily bulb growing area; thus, we would not expect exposure to chlorpropham in surface water source drinking water from this use. Drinking water concentrations are not estimated for surface-water source drinking water.

In the lily bulb growing region, almost all drinking water is obtained from groundwater in the shallow aquifers. A complete list of all public drinking water facilities (ground and surface water source) serving 25 people or more is in Attachment 1. In addition, approximately 200 private wells are located in this area, the majority of which tap the shallow aquifer. Based on it's hydrogeology and historical contamination from application of pesticides to lily bulbs to control nematicides, the ground water in this area should be considered to be vulnerable to contamination from surface applied chemicals.

EFED has used the ground water regression model SciGrow to estimate concentrations in ground water source drinking water which could result from the use of chlorpropham on lily bulbs. Because the water wells in the lily-growing area are located in an area that is more vulnerable to ground water contamination than the wells used for development of SciGrow, the SciGrow-generated concentrations are not expected to represent highly protective values. There is quite a bit of uncertainty regarding the extrapolation of SciGrow values to longer-term concentrations and to multiple-year applications, as well as to sites such as the lily-growing region. Nevertheless, the SciGrow values represent our best available estimate of chronic concentration but should not be regarded as more than order-of-magnitude estimates. Additionally, accurate assessments of the contamination potential posed by chlorpropham and 3-chloroaniline is hampered by the near complete lack of environmental fate data for both compounds, requiring us to estimate parameters, as described later.

The range of estimated drinking water concentrations (ground water only) are given in Table 1. **Chlorpropham concentrations are estimated to be 100 ppb.** We estimate that **average annual concentrations of 3-chloroaniline could range from 0.2 ppb to 8 ppb.** There is greater uncertainty associated with parent chlorpropham than the degradate due to greater conservatism in model input parameters.

Table 1. Ground water estimated concentrations (EECs) for chlorpropham and 3-chloroaniline SciGrow.

compound	3-chloroaniline				chlorpropham
	Half life = 14 days	Half life = 30 days	Half life = 60 days	Half life = 90 days	Half life = infinite
Koc = 40				7.9 ppb	
Koc = 72		0.87 ppb	2.4 ppb	4.2 ppb	
Koc = 100	0.19 ppb				
Koc = 0					100 ppb[*]

[*]previously reported value from R. Parker memo of Feb 26, 1999

Extent and Pattern of Use

Current outdoor use for Chlorpropham is limited to 300 pounds a.i. used in Washington D.C. on Gingko trees and 300 pounds a.i. used by nine growers of Easter Lillies in Curry County, Oregon and Del Norte County, California. The area in which these Easter lilies are grown is along a 13-mile strip between the Chetco River in Oregon south to the Smith River in California, between Highway 101 and the Pacific Ocean.

Environmental Fate Parameters

Since there is nearly a complete lack of environmental fate data for both chlorpropham and 3-chloroaniline, we were forced to estimate relevant model input parameters. The only validated environmental fate study for chlorpropham is a hydrolysis study, which

showed that the compound is stable. For chlorpropham, previous drinking water estimates were made using the GENEEC and SciGrow models and by assuming that chlopropham was stable, had a Koc of zero, and that chlorpropham was used at one half the labeled application rate (memo by Ron Parker, Feb 26, 1999, no DP Barcode).

In an attempt to provide more realistic parameters for the degradate 3-chloroaniline, we estimated the mobility and degradation parameters from EPA's EPIWIN (version 3.1). This estimation method is not nearly as protective as EFED's standard method of dealing with chemicals that lack fate data (i.e., assuming stability and high mobility), and as with any empirical estimation program there will be considerable uncertainty as to the accuracy of the parameter estimates. Results of EPIWIN for 3-chloroaniline are given in Attachment 3. The environmental fate inputs for Scigrow are Koc, which EPIWIN estimates as 72 ml/g and the biodegradation rate which EPIWIN estimates on the order of weeks to months. In order to address the uncertainty in these parameters to some degree, EFED ran SciGrow with Koc values ranging from 40 to 100 and degradation half lives ranging from 14 to 90 days. The application rate for 3-chloroaniline was estimated by multiplying the parent application rate by the ratio of the molecular weights of 3-chloroaniline (MW = 127.57) to chlorpham (MW =213.7). This application rate is reasonable since it is likely from examination of the structure of chlorpropham that 3-chloroaniline will result from degradation of chlorpropham at some point in the process. However the degradation rate of chlorproham itself, and therfore the production rate of 3-chloroaniline, is unknown.. The SciGrow model runs are given in Attachment 2

Table 2. Chlopropham and 3-chloroaniline Input Parameters Used in SciGrow

Chemical	Chlorpropham	3-chloroaniline
PC Code	018301	
Molecular Weight	213.7	127.57
Hydrolysis	$T_{1/2}$ = stable	
Photolysis	$T_{1/2}$ = stable (No study)	
Aerobic Soil Metabolism	$T_{1/2}$ = stable (No study)	14 to 90 days (EPIWIN)
Aerobic Aquatic Metabolism	$T_{1/2}$ = stable (No study)	
Soil-Water Partitioning Coef	(K_{oc}) = 0.0 (No study)	72 ml/g (EPIWIN)
application rate (lb/ai/A)	2 (max label rate: 4)	2.38 (4 lb/acre*127/213.7)
Number of appications	1	1
Date of assessment	January 15, 1999	May 31, 2002

Modeling Uncertainty Discussion

SCIGROW provides a ground water screening exposure value for determining the potential risk to human health from drinking water contaminated with pesticide. Risk managers have raised several questions regarding the applicability of SciGrow to the specific lily growing area, including the vulnerability of the lily growing area with respect to its hydrogeology, the effect of the specific pesticide application method to lilies, the timing of the pesticide application, and the relevance of the SciGrow values with respect to long-term exposure values. These issues are discussed here.

The area in which these Easter lilies are grown contain approximately 200 private wells. The vast majority of these wells are less than 50 feet deep and draw from an aquifer with a water table that ranges from 10 to 30 feet below the ground surface. This area is at least as vulnerable to ground water contamination as the study areas used for SciGrow development, which were characteristic of hydrogeologically vulnerable areas with highly permeable, unconfined aquifers, and water table depths of 20 feet or less. Thus, estimates for the lily area should be considered reasonable rather than conservative from this perspective. In addition, CALDPR has identified Del Norte County as particularly vulnerable to ground water contamination, as a result of historical contamination from application of pesticides to lily bulbs to control nematicides. Several of these pesticides have subsequently been banned from use in the area (aldicarb, 1,2-D).

In regard to the specific application method for chlorpropham to lily fields, it should be noted that the data used to calibrate SciGrow considered cropped fields in which the crops were harvested and removed. Thus, the fact that chlopropham is sprayed onto the Easter lilies and these Easter lilies are subsequently harvested is already implicitly considered in the SciGrow model calculations.

Chorpropham is used around May, which is the beginning of a season with less precipitation than the remainder of the year. During drier periods in the absence of equivalent irrigation, it would be expected that contaminant transport to ground water would be slower than at wetter times. The lily bulb fields are irrigated during these drier periods. We do not know of any mechanism that could transport chlorpropham or its degradates 3-chloroaniline out of the lily-growing area prior to subsequent rains. The only conclusion we can draw from this fact is that transport of chlorpropham or 3-chloroaniline to the groundwater may be delayed. With annual applications of chorpropham, such a delay would not have much effect on concentrations for stable compounds.

SciGrow model estimates represent a high ninety-day average concentration which could be expected from a single application in a year. This value is expected to be somewhat higher than the annual average concentration which could be expected to occur, and thus the EECs can be considered to be reasonably conservative estimates of annual (or lifetime) concentrations to which people may be exposed.

Note on Surface Water

Curry County, Oregon has a 1997 projected population 21,283 people. The county has 28 public water supply facilities which derive their water from ground water and serve a population of 14,972, and nine systems which derive their water from surface water and serve a population of 2,051. The Curry County, Oregon drinking water systems included in the Safe Drinking Water Information System (SDWIS) are listed in Attachment 1. Del Norte County, Oregon has a 1997

projected population 28,285 people. The county has 13 ground water systems serving a population of 400 and four surface water systems serving a population of 125. Del Norte county drinking water systems included the Safe Drinking Water Information System (SDWIS) are in Attachment 1. All of these surface water plants are outside of the range of potential contamination by the lily field area.

Attachment 1: Regulated public water supply systems in Curry Co., OR and Del Norte Co., CA

List of Water Systems in SDWIS in Curry County Oregon

Water systems in OREGON are regulated by OREGON HEALTH DIVISION

For a detailed Violation and Enforcement History click on the underlined Water System ID.

Water System ID	Water System Name	Principal County Served	Population Served	Primary Water Source Type
OR4101201	ANCHOR MOBILE HOME PARK	CURRY	70	Ground water
OR4101365	ANGLERS' TRAILER VILLAGE	CURRY	88	Ground water
OR4191194	ARIZONA BEACH RV PARK	CURRY	100	Ground water
OR4101408	ATRIVERS EDGE RV RESORT	CURRY	220	Ground water
OR4100465	BANDON/PORT ORFORD KOA	CURRY	75	Ground water

OR4100149	BROOKINGS, CITY OF	CURRY	5200	Ground water
OR4191196	CEDAR BEND SNACK BAR	CURRY	100	Ground water
OR4191198	COUGAR LANE STORE/LODGE/CAMPGD	CURRY	152	Ground water
OR4194742	CURRY CO.PKS-BOICE COPE PARK	CURRY	36	Ground water
OR4191209	CURRY CO.PKS-LOBSTER CREEK	CURRY	120	Surface water
OR4194398	ELK RIVER CAMPGROUND	CURRY	52	Ground water
OR4191199	FOUR SEASONS TRAILER RESORT	CURRY	100	Surface water
OR4101059	GOLD BEACH, CITY OF	CURRY	3000	Ground water
OR4100150	HARBOR WATER P.U.D.	CURRY	3000	Ground water
OR4191201	HUMBUG MTN.RESTAURANT/ LODGE	CURRY	25	Ground water
OR4190869	JOHN HANCOCK - HUNTLEY PARK	CURRY	25	Ground water

OR4193429	KIMBALL CREEK BEND RESORT	CURRY	120	Ground water
OR4100466	LANGLOIS WATER DISTRICT	CURRY	250	Surface water
OR4191203	LUCAS PIONEER RANCH & LODGE	CURRY	100	Ground water
OR4194366	LUCKY LODGE TRAILER PARK	CURRY	74	Ground water
OR4191205	MARIAL LODGE	CURRY	92	Surface water
OR4100329	NESIKA BEACH WATER DISTRICT	CURRY	1200	Ground water
OR4191017	OPRD CAPE BLANCO STATE PARK	CURRY	200	Ground water
OR4191018	OPRD HUMBUG MOUNTAIN CAMP-O/N	CURRY	110	Surface water
OR4191019	OPRD LOEB STATE PARK	CURRY	400	Ground water
OR4191211	PACIFIC HIGH SCHOOL, SD 2J	CURRY	183	Ground water
OR4191207	PARADISE BAR LODGE	CURRY	100	Surface water
OR4100670	PORT ORFORD, CITY OF	CURRY	1034	Surface water

OR4101361	**RAINBOW ROCK CONDOMINIUMS**	CURRY	120	**Surface water**
OR4101062	**RAINBOW ROCK VILLAGE**	CURRY	125	**Surface water**
OR4100330	**RIVERBOAT VILLAGE MOBILE PARK**	CURRY	50	**Ground water**
OR4191215	**SINGING SPRINGS LODGE & CAFE**	CURRY	25	**Ground water**
OR4191213	**UPPER CHETCO ELEMENTARY, SD 23**	CURRY	80	**Ground water**
OR4192694	**USFS LITTLE REDWOOD CAMPGROUND**	CURRY	57	**Ground water**
OR4192704	**USFS QUOSATANA CAMPGROUND**	CURRY	100	**Ground water**
OR4192693	**USFS WINCHUCK CAMPGROUND**	CURRY	40	**Ground water**
OR4194489	**WHALESHEAD BEACH RV PARK**	CURRY	200	**Ground water**

List of Water Systems in SDWIS for Del Norte County, California

Water systems in CALIFORNIA are regulated by CALIFORNIA DRINKING WATER PROGRAM

For a detailed Violation and Enforcement History click on the underlined Water System ID.

Water System ID	Water System Name	Principal County Served	Population Served	Primary Water Source Type
CA0800795	BAR-O RANCH	DEL NORTE	45	Ground water
CA0800662	BIG FLAT CAMPGROUND	DEL NORTE	0	Ground water
CA0800664	CEDAR RUSTIC CAMPGROUND	DEL NORTE	0	Ground water
CA0800646	DEL NORTE ASSOC. DEV. SERV.	DEL NORTE	0	Ground water
CA0800650	FORT DICK BIBLE SCHOOL	DEL NORTE	0	Ground water
CA0800821	J N' G NORTHCREST WATER SYSTEM	DEL NORTE	0	Ground water
CA0800803	LAKE EARL GROCERY	DEL NORTE	0	Ground water
CA0800631	MILLER REDWOOD COMPANY	DEL NORTE	25	Surface water
CA0800810	MR. C'S WATER SERVICE	DEL NORTE	0	Ground water
CA0800618	NORTH FORK WATER ASSOC.	DEL NORTE	14	Ground water
CA0810503	REDWOOD NP - DEMARTIN HOSTEL	DEL NORTE	30	Ground water
CA0800644	REQUA INN	DEL NORTE	40	Surface water
CA0800819	REQUA RESORT WATER SYSTEM	DEL NORTE	0	Surface water
CA0800850	SEA WEST RESTAURANT	DEL NORTE	50	Ground water
CA0800652	SHANGRI-LA TRAILER COURT	DEL NORTE	65	Ground water

CA0800612	TERWER PARK RESORT	DEL NORTE	196	Ground water
CA0800639	WAGON WHEEL MOTEL	DEL NORTE	60	Surface water

Attachment 2: SciGrow Model output for chlorpropham and 3-chloroaniline, and EPA's EPIWIN (version 3.1) program output for environmental fate characteristics of 3-chloroaniline

Table 1. SciGrow chlorpropham output

```
RUN No.  1 FOR CHLORPROPHAM      INPUT VALUES
--------------------------------------------------------------------
RATE (#/AC)   NO.      SOIL       SOIL AEROBIC
ONE(MULT)    APPS     KOC       METAB (DAYS)
--------------------------------------------------------------------
2.000(2.000)    1       0.0            0.0
```

```
GROUND-WATER SCREENING CONCENTRATIONS IN PPB
-----------------------------------------------------------------------------
                        100.0
-----------------------------------------------------------------------------
```

Table 2: EPIWIN environmental fate estimates

```
SMILES : Nc(cccc1CL)c1
CHEM   : Benzenamine, 3-chloro-
CAS NUM: 000108-42-9
MOL FOR: C6 H6 CL1 N1
MOL WT : 127.57
--------------------------- EPI SUMMARY (v3.10) ---------------------------
 Physical Property Inputs:
    Water Solubility (mg/L):   ------
    Vapor Pressure (mm Hg) :   ------
    Henry LC (atm-m3/mole) :   ------
    Log Kow (octanol-water):   ------
    Boiling Point (deg C)  :   ------
    Melting Point (deg C)  :   ------

 Log Octanol-Water Partition Coef (SRC):
```

```
      Log Kow (KOWWIN v1.66 estimate) =  1.72
      Log Kow (Exper. database match) =  1.88
         Exper. Ref:  Hansch,C et al. (1995)

Boiling Pt, Melting Pt, Vapor Pressure Estimations (MPBPWIN v1.40):
    Boiling Pt (deg C): 216.05  (Adapted Stein & Brown method)
    Melting Pt (deg C): 24.41   (Mean or Weighted MP)
    VP(mm Hg,25 deg C): 0.0762  (Mean VP of Antoine & Grain methods)
    MP  (exp database): -10.4 deg C
    BP  (exp database): 230.5 deg C
    VP  (exp database): 5.40E-02 mm Hg at 20 deg C

Water Solubility Estimate from Log Kow (WSKOW v1.40):
    Water Solubility at 25 deg C (mg/L):  2331
       log Kow used: 1.88 (expkow database)
       no-melting pt equation used
     Water Sol (Exper. database match) =  5400 mg/L (20 deg C)
        Exper. Ref:  CHIOU,CT ET AL. (1982)

ECOSAR Class Program (ECOSAR v0.99g):
    Class(es) found:
       Aromatic Amines

Henrys Law Constant (25 deg C) [HENRYWIN v3.10]:
  Bond Method :   1.41E-006  atm-m3/mole
  Group Method:   1.86E-006  atm-m3/mole
  Exper Database: 1.31E-06  atm-m3/mole
Henrys LC [VP/WSol estimate using EPI values]:  5.487E-006 atm-m3/mole

Probability of Rapid Biodegradation (BIOWIN v4.00):
    Linear Model        :   0.2706
    Non-Linear Model    :   0.0615
Expert Survey Biodegradation Results:
    Ultimate Survey Model:  2.5757  (weeks-months)
    Primary Survey Model :  3.3900  (days-weeks  )
Readily Biodegradable Probability (MITI Model):
    Linear Model        :   0.2140
    Non-Linear Model    :   0.1070

Atmospheric Oxidation (25 deg C) [AopWin v1.90]:
  Hydroxyl Radicals Reaction:
     OVERALL OH Rate Constant =  75.7251 E-12 cm3/molecule-sec
     Half-Life =     0.141 Days (12-hr day; 1.5E6 OH/cm3)
     Half-Life =     1.695 Hrs
  Ozone Reaction:
     No Ozone Reaction Estimation

Soil Adsorption Coefficient (PCKOCWIN v1.66):
     Koc    :  72.53
     Log Koc:  1.861

Aqueous Base/Acid-Catalyzed Hydrolysis (25 deg C) [HYDROWIN v1.67]:
    Rate constants can NOT be estimated for this structure!

BCF Estimate from Log Kow (BCFWIN v2.14):
   Log BCF =  0.748  (BCF = 5.592)
      log Kow used: 1.88 (expkow database)
```

```
Volatilization from Water:
   Henry LC:  1.31E-006 atm-m3/mole  (Henry experimental database)
   Half-Life from Model River:     505.9  hours   (21.08 days)
   Half-Life from Model Lake :     5614  hours   (233.9 days)

Removal In Wastewater Treatment:
   Total removal:              2.22  percent
   Total biodegradation:       0.09  percent
   Total sludge adsorption:    2.05  percent
   Total to Air:               0.07  percent

Level III Fugacity Model:
         Mass Amount   Half-Life   Emissions
         (percent)       (hr)       (kg/hr)
  Air       0.295        3.39        1000
  Water     41.8         900         1000
  Soil      57.7         900         1000
  Sediment  0.132       3.6e+003      0
     Persistence Time: 550 hr
```

Table 3. SciGrow 3 chloroaniline output

```
 RUN No.  1 FOR 3 chloroaniline    INPUT VALUES
 ------------------------------------------------------------------
 APPL (#/AC) APPL.  URATE   SOIL   SOIL  AEROBIC
 RATE      NO. (#/AC/YR) KOC  METABOLISM (DAYS)
 ------------------------------------------------------------------
  2.400    1    2.400    72.0    30.0
```

```
        GROUND-WATER SCREENING CONCENTRATIONS IN PPB
    ---------------------------------------------------------
            .873962
    ---------------------------------------------------------
 A=  25.000 B=  77.000 C=   1.398 D=   1.886 RILP=   2.955
 F=   -.439 G=    .364 URATE=   2.400 GWSC=       .873962
```

```
 RUN No.  2 FOR ca            INPUT VALUES
 ------------------------------------------------------------------
 APPL (#/AC) APPL.  URATE   SOIL   SOIL  AEROBIC
 RATE      NO. (#/AC/YR) KOC  METABOLISM (DAYS)
 ------------------------------------------------------------------
  2.400    1    2.400    72.0    60.0
```

GROUND-WATER SCREENING CONCENTRATIONS IN PPB

            2.415226

A= 55.000 B= 77.000 C=   1.740 D=   1.886 RILP=   3.678
F=   .003 G=   1.006 URATE=   2.400 GWSC=   2.415226

 RUN No. 3 FOR ca   INPUT VALUES

 APPL (#/AC) APPL. URATE   SOIL   SOIL AEROBIC
 RATE   NO. (#/AC/YR) KOC METABOLISM (DAYS)

  2.400   1   2.400   72.0   90.0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB

            4.233470

A= 85.000 B= 77.000 C=   1.929 D=   1.886 RILP=   4.078
F=   .246 G=   1.764 URATE=   2.400 GWSC=   4.233470

 RUN No. 5 FOR ca   INPUT VALUES

 APPL (#/AC) APPL. URATE   SOIL   SOIL AEROBIC
 RATE   NO. (#/AC/YR) KOC METABOLISM (DAYS)

  2.400   1   2.400   40.0   90.0

 GROUND-WATER SCREENING CONCENTRATIONS IN PPB

            7.966222

A= 85.000 B= 45.000 C=   1.929 D=   1.653 RILP=   4.528
F=   .521 G=   3.319 URATE=   2.400 GWSC=   7.966222

 RUN No. 6 FOR ca   INPUT VALUES

 APPL (#/AC) APPL. URATE   SOIL   SOIL AEROBIC

```
   RATE      NO. (#/AC/YR) KOC  METABOLISM (DAYS)
  ------------------------------------------------------------------
   2.400    1    2.400   100.0    14.0



   GROUND-WATER SCREENING CONCENTRATIONS IN PPB
  ----------------------------------------------------------
              .195458
  ----------------------------------------------------------
A=   9.000  B=  105.000  C=   .954  D=   2.021  RILP=   1.888
F=  -1.089  G=    .081  URATE=   2.400  GWSC=      .195458
```